

**CONSERVING FLORIDA'S SEAGRASS RESOURCES:  
DEVELOPING A COORDINATED  
STATEWIDE MANAGEMENT PROGRAM**



**Florida Fish and Wildlife Conservation Commission  
Florida Marine Research Institute  
100 Eighth Avenue SE  
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# CONSERVING FLORIDA'S SEAGRASS RESOURCES: DEVELOPING A COORDINATED STATEWIDE MANAGEMENT PROGRAM



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## SUMMARY OF KEY RECOMMENDATIONS

Effective seagrass management programs are currently active at the local level in several of Florida's coastal areas, and a number of federal, state, and local government agencies are performing regularly scheduled mapping and monitoring of seagrass habitats within their jurisdictions. However, the state of Florida does not yet have a coordinated, statewide program for managing its seagrass resources. The following steps are recommended to develop and initiate such a program:

### A Development of Regionally-Based Statewide Goals

1. With coordination and logistical support provided by the Florida Coastal Management Program, a combination of state and federal agencies and local governments should work cooperatively to identify quantitative, consensus-based, seagrass coverage goals for each of Florida's five seagrass regions.
2. These goals should be specific, measurable, technically defensible, ecologically appropriate, and achievable within a specified time period.
3. The regional goals should be developed by a statewide technical advisory committee (TAC) and should be based on input from a wide range of local stakeholders.
4. In local areas where seagrass management goals have already been developed, such as Tampa Bay and the Indian River Lagoon, those goals should be reviewed and—if found appropriate—adopted by the TAC as a component of a larger regional goal.
5. The sum of these regional goals will represent the statewide seagrass management goal.

### B Development of Management Strategies

1. The TAC assembled to develop the regional and statewide coverage goals should also be tasked with developing clear strategies for achieving those goals.
2. The strategies should include a list of agency responsibilities and timelines for achieving the regional and statewide goals.

### C Implementing the Strategies

1. Following approval of the strategies, an interagency memorandum of understanding (MOU) should be drafted to guide their implementation.
2. Participation in the MOU should be open to the participating agencies and to other public or private organizations that wish to make a significant commitment to statewide seagrass management.
3. The MOU should specify the steps each participating organization proposes to take to implement the agreed-upon strategies, the time frame within which those steps are proposed to occur, and an estimate of the resources that need to be budgeted to accomplish the work.

### D Evaluating and Reporting Progress Toward Goals

1. The state should develop a methodologically consistent statewide program for mapping and monitoring seagrass coverage and condition.

2. The results of the mapping and monitoring program should be summarized and reported to the public in a timely manner (e.g., every 2–3 years) and should be made available to managers, scientists, and other interested parties through a relational database that is publicly accessible via the Internet.
3. The 2–3 year summary reports should be used by the state to evaluate the progress made toward meeting its seagrass management goals.
4. On a less frequent basis (e.g., every 4–6 years), the results should be used to assess, and if necessary, refine and improve the state’s seagrass management goals and strategies.

E Management-Related Research

1. The state should identify and prioritize existing management-related research needs with respect to seagrass conservation.
2. The annual and long-term costs of carrying out the necessary research should be estimated.
3. Adequate funding should be budgeted to carry out the work.

F Public Outreach

1. The state should support existing outreach efforts by assisting in the distribution of accurate information about the status of Florida’s seagrasses and stressors affecting them.
2. A “Citizens’ Report on the Status of Florida’s Seagrasses” should be prepared and distributed on a regular basis (e.g., every 2–3 years).
3. A statewide teaching curriculum introducing students to Florida’s seagrasses, the environmental and economic value of seagrasses, and the state’s seagrass conservation goals should be developed and implemented.

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## ACKNOWLEDGMENTS

Information and data used in this report were gleaned from a variety of sources including technical reports; federal, state, and local seagrass monitoring and management programs; and historical documents. Source materials and other suggested readings are listed in Section 11.

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## 1. INTRODUCTION

### Report Purpose and Scope

This report is intended to serve as a non-technical planning document; it provides a conceptual framework for the development of a coordinated, statewide seagrass management initiative, while recognizing, supporting, and building on the accomplishments of local, community-based programs.

Effective local seagrass management programs are currently underway in several areas of Florida, primarily in subtropical portions of the peninsula (e.g., Indian River Lagoon, Florida Bay, Sarasota Bay, and Tampa Bay). In addition, a number of federal, state, and local government agencies conduct regularly scheduled mapping and monitoring of seagrass habitats within their jurisdictions. However, the state of Florida does not yet have a coordinated statewide program for managing its seagrass resources. This report recommends a series of steps that could be taken to initiate a coordinated, cooperative, multi-agency program.

The plan outlined herein provides a framework for quantitative management goals for the five distinct regions of the state (Fig. 1) that currently have extensive seagrass resources. It also provides recommendations regarding the state's potential role in developing the following:

- Consensus-based seagrass management strategies at the regional and statewide level
- A methodologically consistent, statewide seagrass mapping and monitoring program
- A schedule for reporting regional and statewide status and trends information
- A schedule for assessing the state's management strategies and the progress made toward achieving the adopted management goals
- A management-oriented, statewide seagrass research program
- A statewide, public outreach program focused on seagrass management and conservation

The process of developing a statewide seagrass management program should not be allowed to impede or delay progress in the local areas where effective community-based programs are already in place. The statewide program should review and, if appropriate, adopt existing seagrass management goals and strategies developed by local stakeholder groups. A primary purpose of the statewide program should be to provide increased support for—and greater statewide consistency in the implementation of—the various components of seagrass management. To avoid unnecessary duplication of effort, the program should build on accomplishments at the local level and work cooperatively with local management programs.

It is assumed that the statewide management program will be guided by a statewide management plan. The plan should be a “living document” that is revisited every 4 to 6 years, as statewide summaries of seagrass status and trends are updated and reported to the public. Of necessity, this initial planning document focuses on basic procedural issues, providing a brief overview of Florida's existing seagrass resources and a list of recommendations for the participating organizations to consider as they work to initiate a consistent, coordinated statewide management effort.

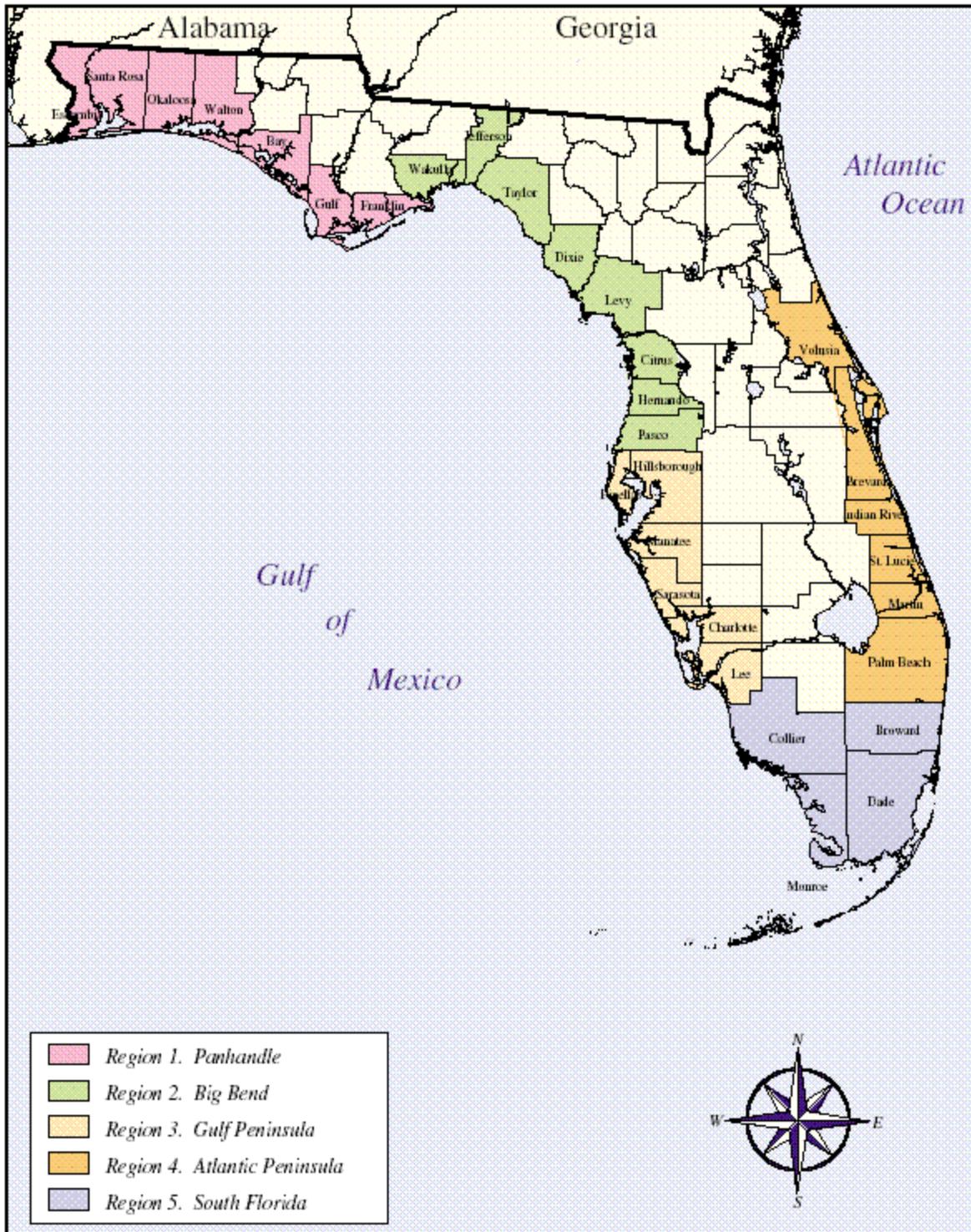


Figure 1. Regions of Florida containing significant seagrass resources.

## Background

The need for a statewide seagrass management program was formally explored during a facilitated workshop held in June 2000 at the Florida Marine Research Institute (FMRI) in St. Petersburg. FMRI Director Ken Haddad, now Executive Director of the Florida Fish and Wildlife Conservation Commission, convened the session.

The one-day workshop brought together representatives of key organizations to discuss Florida's approach to seagrass management, focus on the existing roles and activities of state and federal agencies, and identify areas in which coordination and oversight could be improved. Various regulatory and non-regulatory management issues were discussed. Workshop participants also addressed existing seagrass management and monitoring activities, areas in which improved collaboration would be beneficial, and "missing links" in data or information that would enable them to perform their duties more effectively.

In general, participants supported the concept of a statewide seagrass management program that would serve as an overall blueprint for guiding long-term protection and enhancement of the state's more than 2.7 million acres of seagrass meadows.

In 2000, Workshop participants identified the following key seagrass management issues:

- Attention to and understanding of the status of seagrass resources throughout the state is uneven. Highly focused management and monitoring programs are underway in some areas—such as Florida Bay, Indian River Lagoon, Sarasota Bay, and Tampa Bay—where sufficient resources are available to support these activities. Mapping and monitoring projects in other portions of the state are conducted on a less frequent and less consistent basis, due, in part, to a lack of funding and other resources in those areas.
- No central database exists for the storage and retrieval of mapping and monitoring data.
- No strategic plan exists to identify priority management, monitoring, or research activities.
- Standardized statewide mapping or monitoring techniques have not yet been developed.
- Regulatory activities by federal, state, regional, and local government agencies often emphasize a piecemeal, case-by-case view of impacts to individual seagrass habitats, rather than a broader, more comprehensive approach capable of preserving the integrity of seagrass-based ecosystems.

Participants offered the following key recommendations:

- Specific, quantitative targets for seagrass recovery or preservation are important tools.
- The state has a critical role to play as a facilitator in guiding long-term management of seagrass resources.
- Monitoring and mapping efforts should be coordinated statewide, and standard protocols for monitoring and mapping should be developed.
- Any strategic plan developed by the state should recognize regional differences in seagrass resources, impacts, and research and monitoring priorities, as well as successful local and regional management activities.
- Efforts to inform the public about the economic and environmental value of seagrass should be expanded and coordinated on a statewide level.

- A central clearinghouse for data related to seagrass coverage, trends, and impacts is needed..
- Linking science and management is crucial to the success of seagrass conservation efforts and to achieving public support for conservation initiatives.
- Collaboration at all levels of government, including the regulatory and law enforcement arenas, should be improved. Additionally, collaboration is desirable among agencies and non-profit or private organizations promoting seagrass protection.

### **Another State's Experience: Some Lessons from Texas**

Texas, like Florida, is a large coastal state with significant seagrass resources. Like Florida, legal and regulatory authority for seagrass management in Texas waters is divided among a number of state and federal agencies and local governments. No single agency has the authority, the funding, or the staff resources to develop and implement a coordinated, statewide seagrass management program. Recognizing the environmental and economic importance of seagrass habitats and the fragmented nature of the state's regulatory authority and management resources, the Texas Parks and Wildlife Department (TPWD), in partnership with the Texas Natural Resource Conservation Commission, the Texas General Land Office (TGLO), and several federal resource management organizations, initiated a multi-stakeholder planning effort in 1995. That effort produced a plan for the development and implementation of a statewide program to coordinate seagrass research, conservation, and management. The plan is available via the Internet: [www.tpwd.state.tx.us/texaswater/coastal/seagrass/plan/navbar.htm](http://www.tpwd.state.tx.us/texaswater/coastal/seagrass/plan/navbar.htm).

The planning process underway in Texas offers a number of lessons that can be used during the development of a comparable statewide management program for Florida. The following extended excerpts from the current Texas plan highlight several of those lessons:

“The development of this planning document started with work by the Resource Protection Division, TPW, when evidence of boat propeller scarring was extensively noted in many seagrass beds of Texas bays.”

“A decision was made to initiate a conservation planning effort to identify resource management problems, enumerate planning objectives, and develop long and short range strategies and actions to protect and preserve Texas seagrasses.”

“A planning team was organized to draft a conceptual planning document, conduct a Seagrass Symposium and Workshop, and then compile and prepare this published document. These activities have taken place over the last three years (since 1995). Because of statutory management authority over coastal public waters or biological resources therein, three state agencies (Texas Parks and Wildlife, Texas General Land Office, and Texas Natural resource Conservation Commission) have taken the lead in guiding plan development. In addition, the two National Estuary Programs, Corpus Christi Bay and Galveston Bay, were actively involved. This multiuser/multistakeholder approach provides a good model for resource management and conservation that can be implemented at a local level through such a Seagrass Plan.”

## **Management/Policy Issues**

“A sound management process that coordinates agency policies, public awareness, and existing research knowledge is needed to achieve effective seagrass conservation, while allowing for economic development. Management objectives were identified that address four problem areas: (1) seagrass beds are being lost or degraded, and/or species composition is changing; (2) agency coordination may prevent adequate management; (3) data synthesis and monitoring are insufficient for management decisions and need to be focused on management needs; and (4) public outreach is too limited to achieve the goal of public awareness. Objectives addressing these problems fall into three primary categories – regulatory, management, and educational policies.”

## **Regulations**

“Regulatory policies for effective management involve ensuring water and sediment quality and coordinating and strengthening the mitigation sequence and guidelines. Beneficial water and sediment quality for seagrass communities involves establishing seagrass habitat as a specific aquatic life use in the Texas Surface Water Quality Standards. Additional evaluation would be needed to develop criteria or screening levels, such as suspended sediment, nutrient concentrations, turbidity, and salinity, for seagrass protection. Watershed management programs can protect water and sediment quality by promoting non-regulatory management activities. Implementation of Best Management Practices (BMPs), especially water-based BMPs, are needed to address impacts from runoff.”

“Federal and state regulations and programs that help protect seagrasses are primarily the Section 404 and 401 Permits of the Clean Water Act and the Texas Coastal Management Program (CMP). The mitigation sequence of avoidance, minimization, and compensation is in the Section 404(b)(1) Guidelines and is the substantive environmental standard by which all Section 404 permit applications are evaluated. The Texas Natural Resource Conservation Commission rules for Section 401 Certification and the CMP policies have incorporated key components of the Section 404 (b)(1) Guidelines. However, improvement is needed in coordinating the permitting process. In addition, the mitigation sequence needs to be strengthened and guidelines for avoidance of seagrass impacts emphasized.”

## **Management Programs**

“Management programs focus on 1) seagrass restoration, enhancement, and creation; 2) dredging and shoreline development; 3) policy consistency; and 4) research, data acquisition, and monitoring. Restoring and enhancing seagrasses was originally reported as being largely unsuccessful. Recently, many seagrass

restoration projects have been successful, especially the restoration of shoalgrass (*Halodule wrightii*). In order to increase the success rate of restoration projects, management efforts need to be directed toward strengthening current restoration guidelines and providing increased research on successful planting techniques.”

“Dredging of new canals and maintenance dredging of channels may cause mortality of seagrasses from burial or inhibit growth from turbidity and light reduction. Development along shorelines may affect conditions of water depth and currents and cause loss of seagrasses. Best Management Practices are needed to protect seagrasses while allowing for development of coastal resources.”

“Consensus among user groups over controversial issues involving natural resource use is difficult to achieve. The 1994 Beneficial Uses Group Plan for the Houston Ship Channel deep-draft navigation project is an example of a model plan or consensus agreement that minimized the ecological and sociological impacts of dredging by maximizing the beneficial uses of dredged material.”

“Policies affecting seagrasses are present in many agencies and may be written with only one agency and its specific regulatory authority in mind. Future policies should be prepared in a holistic framework and existing policies examined for flexibility and to ensure that goals are achieved.”

“Research, data acquisition, and monitoring need to be focused on management needs, i.e., on the water quality requirements of seagrasses. Management efforts will depend upon the development of new approaches that utilize a watershed approach to using water quality parameters to control import of nutrients into estuaries. Monitoring programs are needed for status and trends information and to help evaluate management actions. Ecological studies are needed to develop dependable restoration techniques. Sound, scientific data are needed to provide reliable information for application to management.”

### **Education and Outreach Issues**

“Education, not regulation, has the greatest potential for conservation and restoration of seagrass ecosystems in Texas estuaries. A diverse group of stakeholders in Texas’ coastal ecosystems developed a vision and plan for education and outreach in support of seagrass conservation. We envision a Texas where awareness, knowledge, concern, and skills will result in responsible behavior that conserves the seagrasses of our state. Conservation education programs can take citizens from ignorance of seagrass ecosystems through awareness, understanding, and concern to practicing responsible behavior in regard to this ecosystem.”

“Education and outreach objectives should assist in developing a sense of community stewardship and individual responsibility for seagrass conservation.

Relevant information should be presented clearly, accurately, and with common-sense ideas for the public. State and federal agencies should strengthen their commitment to outreach programs.”

### **Plan Implementation**

“The final section deals with implementation of immediate, high priority strategies and identifies appropriate participants in the process. TPW, TGLO, and TNRCC have targeted and committed to a number of these high priority objectives as part of their agency programs. In addition, the roles of the State Wetlands Conservation Program, the two Texas National Estuary Programs, and public education and outreach programs are clarified and outlined as implementation mechanisms.”

Florida’s seagrass management effort is in a position to learn from and build on the Texas experience. Many elements of the Texas program have been incorporated in the planning framework described in Sections 2–10. Florida should move from this initial planning stage to implementation of a coordinated, statewide seagrass management program as expeditiously as possible.

## 2. FLORIDA'S SEAGRASSES

Seagrasses are flowering marine plants that live submerged in Florida's lagoons, bays, and other coastal waters. Because seagrasses require sunlight to flourish, the densest and most luxuriant beds are usually found in shallow, clear waters at depths of three meters or less. Seagrass health is inextricably linked to water quality: the clearer the water, the deeper seagrasses can grow. Activities that affect water quality and clarity, such as dredging and filling or excessive nutrient loading from urban, industrial, and agricultural land uses, may severely restrict the growth of seagrasses or cause them to disappear altogether.

Seven species of seagrass are found in Florida waters (Fig. 2). Florida's largest seagrass species, *Thalassia testudinum* (turtle grass), has long strap-shaped leaves and robust rhizomes. In the marine environment, extensive meadows are usually dominated by this species, in combination with *Syringodium filiforme*. *Syringodium* (manatee grass) can be distinguished by its cylindrical leaves, which, because they are brittle and buoyant, are frequently broken off from the parent plant, and widely dispersed by winds and currents. *Halodule wrightii* (shoal grass) has flat, narrow leaves and a shallow root system. It is thought to be an early successional species in the development of seagrass beds in the gulf and Caribbean and is a dominant species in many estuarine environments. *Halodule* is able to survive more frequent and prolonged exposure during periods of low tide; it is often the predominant species at the shallow-water fringe of large meadows. In some areas, *Halodule* also dominates the deep-water edge of many meadows.

Three additional species (*Halophila engelmannii*, *Halophila decipiens*, and *Halophila johnsonii*) are also found in Florida's coastal waters. *Halophila engelmannii* is often present in meadows dominated by *Thalassia* and *Syringodium*, but it also occurs in deeper areas where these species are absent. *Halophila decipiens* is found in both inshore and offshore areas. Reported from depths of up to 90 m near the Dry Tortugas, it forms single-species stands (to depths of 20 m or more) beyond the deep edge of the extensive *Thalassia/Syringodium* meadows in the Big Bend region. *Halophila johnsonii* is a relatively newly described species that is morphologically similar to *H. decipiens*. Because of its highly restricted geographic range (northern Biscayne Bay to Sebastian Inlet, on Florida's east coast) and potential vulnerability to extinction due to chance disturbance events, the U.S. Fish and Wildlife Service recently listed *Halophila johnsonii* as a threatened species.

A seventh species, *Ruppia maritima* (widgeon grass), tolerates a wide range of salinities. It is often encountered on Florida's west coast, particularly in estuaries such as Homosassa Bay. The species can form dense beds, such as those found in upper Tampa Bay. In recognition of its broad salinity tolerance, some researchers have suggested that *Ruppia maritima* might be thought of as a freshwater plant that is also capable of living in saline environments.

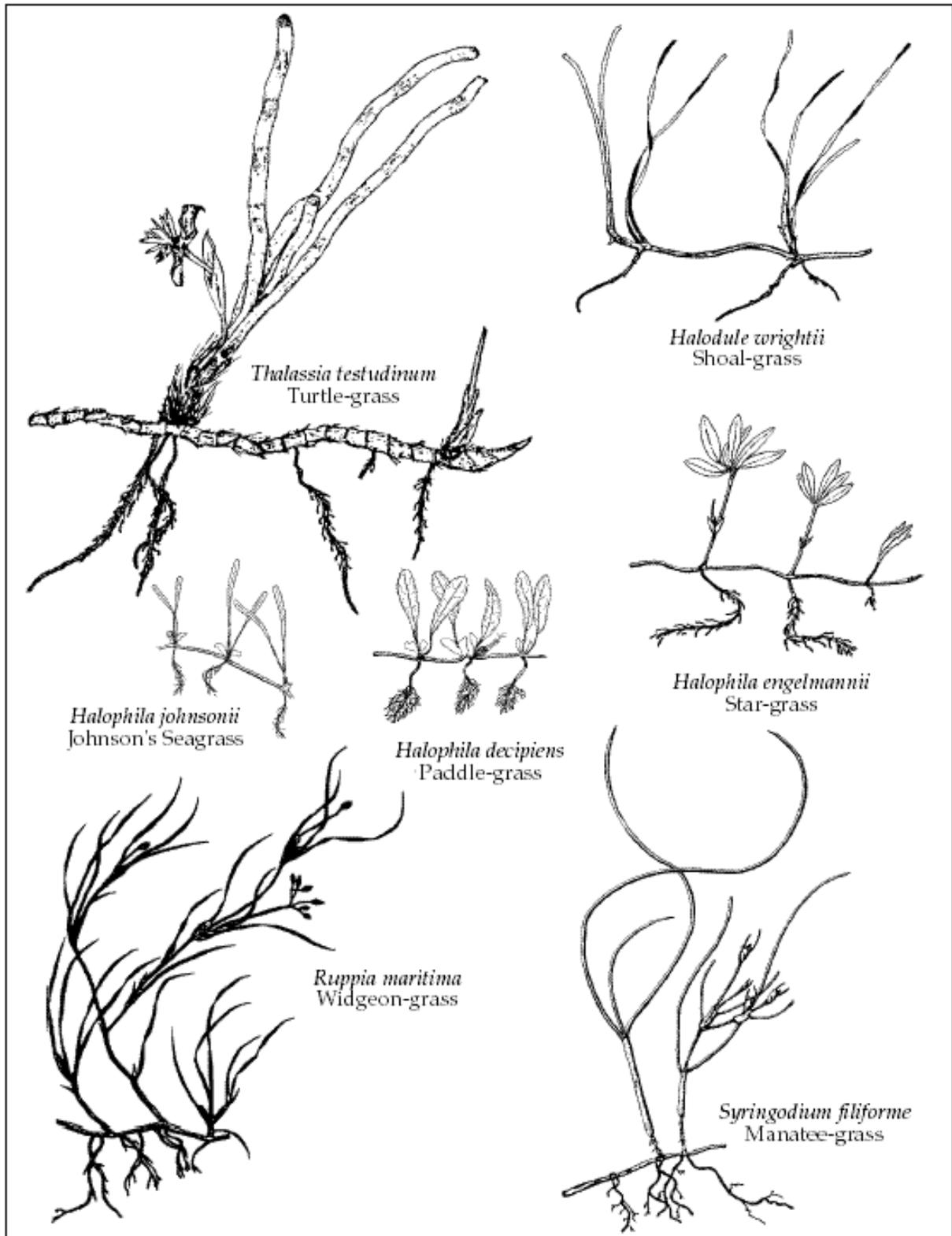


Figure 2. Seagrass species occurring in Florida (from Sargent et al. 1995, based on drawings by Mark D. Moffler).

### 3. ENVIRONMENTAL AND ECONOMIC VALUE OF SEAGRASS HABITATS

The approximately 2.7 million acres of seagrass beds that occur in Florida's coastal waters represent key components of the state's marine environment and economy. They help to maintain water clarity by trapping fine sediments and particles with their leaves and stabilizing bottom sediments with their root systems and rhizomes. They provide food and shelter for numerous marine organisms, including the endangered West Indian manatee. More than 70% of Florida's recreational and commercial fish, shellfish and crustacean species spend part of their lives in seagrass beds. As a result, the environmental and economic values provided by Florida's seagrasses are substantial. The Smithsonian Marine Station at Fort Pierce has provided the following summary:

“A single acre of seagrass can produce over 10 tons of leaves per year. This vast biomass provides food, habitat, and nursery areas for a myriad of adult and juvenile vertebrates and invertebrates. Further, a single acre of seagrass may support as many as 40,00 fish, and 50 million small invertebrates.”

“Because seagrasses support such high biodiversity, and because of their sensitivity to changes in water quality, they have become recognized as important indicator species that reflect the overall health of coastal ecosystems.”

“Seagrasses perform a variety of functions within ecosystems, and have both economic and ecological value. The high level of productivity, structural complexity, and biodiversity in seagrass beds has led some researchers to describe seagrass communities as the marine equivalent of tropical rainforests. While nutrient cycling and primary production in seagrasses tends to be seasonal, annual production in seagrass communities rivals or exceeds that of terrestrially cultivated areas.”

“As habitat, seagrasses offer food, shelter, and essential nursery areas to commercial and recreational fishery species, and to the countless invertebrates that are produced within, or migrate to seagrasses. The complexity of seagrass habitat is increased when several species of seagrasses grow together, their leaves concealing juvenile fish, smaller finfish, and benthic invertebrates such as crustaceans, bivalves, echinoderms, and other groups. Juvenile stages of many fish species spend their early days in the relative safety and protection of seagrasses. Additionally, seagrasses provide both habitat and protection to the infaunal organisms living within the substratum as seagrass rhizomes intermingle to form dense networks of underground runners that deter predators from digging infaunal prey from the substratum. Seagrass meadows also help dampen the effects of strong currents, providing protection to fish and invertebrates, while also preventing the scouring of bottom areas. Finally, seagrasses provide attachment sites to small macroalgae and epiphytic organisms such as sponges, bryozoans, forams, and other taxa that use seagrasses as habitat.”

“Economically, Florida’s 2.7 million acres of seagrass supports both commercial and recreational fisheries that provide a wealth of benefits to the state’s economy. Florida’s Department of Environmental Protection (FDEP) reported that in 2000, Florida’s seagrass communities supported commercial harvests of fish and shellfish valued at over 124 billion dollars. Adding the economic value of the nutrient cycling function of seagrasses, and the value of recreational fisheries to this number, FDEP has estimated that each acre of seagrass in Florida has an economic value of approximately \$20,500 per year, which translates into a statewide economic benefit of 55.4 billion dollars annually. In Fort Pierce, Florida alone, the 40 acres of seagrass in the vicinity of Fort Pierce Inlet are valued at over \$800,000 annually. When projected across St. Lucie County’s estimated 80,000 acres of seagrass, this figure increases to 1.6 billion dollars per year.”

Comparable estimates of the economic value of seagrass habitats have been developed in other parts of the state. In 2001, the estimated total value of six seagrass-dependent species (including pink shrimp and stone crabs) in Florida was \$117 million. The estimated value of the Florida shrimp industry in 2001 was \$27 million. In Monroe County alone, more than \$200 million is spent yearly on eco-tourism activities such as wildlife viewing and diving. Seagrass meadows in the Indian River Lagoon serve as the backbone of a recreational and commercial fishing industry that has an estimated economic impact of about \$1 billion per year.

## **4. SEAGRASS STATUS AND TRENDS**

### **Background**

Currently in Florida, the only organizations that regularly map seagrasses are the three largest water management districts (the Southwest Florida, St. Johns River, and South Florida districts). These mapping programs are performed at a regional level. The maps are typically updated every two to three years.

In more localized areas, a variety of state and federal agencies conducted mapping sporadically or on a one-time basis. These agencies included the Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission-Marine Research Institute, National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers, U.S. Geological Survey, and the U.S. Minerals Management Service.

A review of available information on seagrass status and trends suggests that long-term coverage losses have occurred in each of the five regions addressed by this plan. In several regions, the most pronounced coverage losses have occurred in highly urbanized estuaries. A regional breakdown of seagrass coverage and trends is as follows.

### **Region 1: Panhandle**

The Panhandle region includes the coastal waters of Franklin, Gulf, Bay, Walton, Okaloosa, Santa Rosa, and Escambia counties. Based on 1992 aerial photography provided by the USGS, this region contains about 42,000 acres of seagrasses, or 2% of the statewide total.

From the 1940s to the early 1970s, a substantial decline in overall submerged aquatic vegetation (SAV) was reported in the Escambia-Pensacola Bay system, including Santa Rosa Sound, Pensacola Bay, Escambia Bay, and Big Lagoon. In recent years, however, improved water quality in three of these four water bodies has led to seagrass expansion. In Santa Rosa Sound and Pensacola Bay, SAV showed significant increased growth; horizontal growth rates of some beds averaging more than 18 inches over one year. In Escambia Bay, most of the earlier SAV losses have been recovered. The most recent study showed continued declines in Big Lagoon.

### **Region 2: Big Bend**

The Big Bend region includes the coastal waters of Pasco, Hernando, Citrus, Levy, Dixie, Taylor, Jefferson, and Wakulla counties. The region, bounded on the landward side by freshwater inflows from 14 river systems and extensive groundwater influx and on the seaward side by the Gulf of Mexico, is a unique “low-energy” coastline that could be considered one vast estuarine area. The most recent estimate of seagrass coverage in this region (based on 1992 USGS aerial photography) was 797,000 acres, which represents 27% of the total seagrass coverage in the state. This is the second largest contiguous area of seagrass habitat in the eastern Gulf of Mexico, making it an important resource not only to Florida but nationally and internationally as well. With the exception of some intensive studies carried out by Florida State University staff, little research or monitoring has been conducted in the region. Recently,

cooperative mapping and monitoring efforts have been initiated by the Southwest Florida Water Management District, the Suwannee River Water Management District, the University of Florida, the Florida Marine Research Institute, and the Gulf of Mexico Program.

Currently, the remoteness of the seagrasses in the Big Bend, combined with the low density of the region's human population, have apparently served to keep seagrass coverage stable. The estuary of the Fenholloway River is the only area where an historical loss of seagrass coverage has been documented; the loss is due to water quality impacts from an upstream pulp mill discharge. Recent improvements in the quality of the mill effluent appear to be permitting some seagrass recovery in that area. Anecdotal references in the scientific literature suggest that historical seagrass coverage may have been higher than the currently observed levels in Suwannee Sound and Waccasassa Bay, but this possibility has not yet been thoroughly investigated.

Based on our understanding of seagrass loss and recovery in other Florida estuaries, maintaining adequate water quality and water clarity will be the major emphasis for conserving seagrass resources in the Big Bend region. The following management activities need to be implemented in the region:

- Continue the mapping and monitoring work recently begun by the Southwest Florida and Suwannee River water management districts. In particular, the Suwannee River Water Management District's work in the northern Big Bend is currently supported by a short-term grant from the Gulf of Mexico Program; this effort needs a dedicated long-term funding source. Long-term programs tracking water clarity and seagrass coverage and condition will be key components of a regional management strategy.
- Conduct the research needed to identify the water quality conditions—including nutrient loadings, turbidity levels, and water clarity—that must be maintained to permit adequate light to penetrate to the deepest seagrass meadows. These will be important management targets, which will be needed to assess the effectiveness of other land use and water quality management efforts.

### **Region 3: Gulf Peninsula**

The Gulf Peninsula region includes the coastal waters of Pinellas, Hillsborough, Manatee, Sarasota, Charlotte, and Lee counties. Based on 1999 aerial photography provided by the South Florida and Southwest Florida water management districts, this region contains approximately 107,000 acres of seagrass, or about 5% of the statewide total.

Due to reductions in pollutant loads and improvements in water quality, some estuarine areas of this region have demonstrated modest to dramatic seagrass coverage gains over the past 25 years. In Tampa Bay, for example, 40% of seagrasses were lost between about 1950 and 1982. However, from 1982 to 1996, more than 5,000 acres were recovered thanks to improved treatment of wastewater and stormwater, as well as restrictions on dredging and filling. Tampa Bay seagrasses suffered a recent setback during the El Niño event of 1998–1999, when 2,000 acres were lost. This was the first decline in bay-wide coverage since 1982. Recent aerial

mapping shows an expansion of about 1,200 acres by 2002, indicating that the system appears to be rebounding from that setback.

Currently, there are about 26,000 acres of seagrass throughout Tampa Bay. Local partners have developed a consensus-based goal of restoring more than 12,000 additional acres, which would bring total coverage back to the levels that occurred in the early 1950s.

In Sarasota Bay, seagrass losses during the 1940s to the 1980s are estimated at approximately 30%. In 1988, the total seagrass coverage was estimated at 8,651 acres. However, changes in seagrass coverage in Sarasota Bay have been dramatic since then. Between 1989 and 1990, nutrient loadings from wastewater treatment plants were reduced by as much as 25%, substantially improving water clarity. Between 1988 and 1996, seagrass coverage in the Manatee County portion of the bay increased by roughly 800 acres; in the Sarasota County portion, seagrass coverage increased by an estimated 670 acres. Most of these increases occurred along the deep edges of existing seagrass beds, suggesting that improved water clarity and light availability were important factors contributing to increased seagrass coverage.

Currently, there are about 9,110 acres of seagrass in Sarasota Bay. The Sarasota Bay National Estuary Program has adopted a restoration approach that seeks to control nitrogen loadings through the use of “best available technologies” to reduce discharges from point and nonpoint sources.

The greater Charlotte Harbor area—which includes Charlotte Harbor proper, along with Lemon Bay, Gasparilla Sound, Pine Island Sound, Matlacha Pass, Estero Bay, and the Caloosahatchee River estuary—is generally less urbanized than either Tampa Bay or Sarasota Bay. As a result of large-scale dredge and fill projects, a portion of the area, primarily in southern Pine Island Sound, lost an estimated 30% of its seagrasses prior to the 1980s. Elsewhere in the area, long-term seagrass coverage appears to be relatively stable.

In 1992, the Southwest Florida Water Management District initiated a biennial mapping project to assess seagrass coverage trends in the portion of the area that falls within its jurisdiction. Currently this area, which includes Charlotte Harbor proper, Lemon Bay, and Gasparilla Sound, contains about 18,000 acres of seagrass.

#### **Region 4: Atlantic Peninsula**

The Atlantic Peninsula region includes the coastal waters of Volusia, Brevard, Indian River, St. Lucie, Martin, and Palm Beach counties. This region contains about 3%, or 74,456 acres, of the state’s total seagrasses.

Seagrasses in this region occur primarily within the Indian River Lagoon system, an estuary that spans about 160 miles of coastline and includes portions of six counties. All seven of Florida’s seagrass species are found in the area. This region displays the highest seagrass diversity of any estuary in the Western Hemisphere. One rare species found only in the southern reaches of the lagoon, Johnson’s seagrass (*Halophila johnsonii*), was designated as federally threatened species

in 1998. Conservation of this scarce and ephemeral species presents unique management challenges.

Based on 1943 coverage estimates, potential seagrass coverage in the lagoon is estimated at 91,570 acres. The Indian River Lagoon National Estuary Program has developed specific recovery or preservation targets for each segment of the lagoon based on the depths at which seagrasses can be expected to grow under adequate water quality conditions.

The Indian River Lagoon Surface Water Improvement and Management (SWIM) Plan, updated in 2002 and available on the South Florida Water Management District Web site ([www.sfwmd.gov](http://www.sfwmd.gov)), provides the following overview of seagrass distribution and trends:

“Lagoon areas containing the largest seagrass coverages are around N. Merritt Island in the federally protected bottomlands of NASA/Kennedy Space Center (North IRL and northern Banana River) and the Canaveral National Seashore (southern Mosquito Lagoon). These areas experienced little change between 1943 and 1999.”

“The largest area with the least seagrass coverage, and with the greatest loss since 1943 (70% loss), extends from Cocoa to just south of Turkey Creek”

“Within the SJRWMD portion of the IRL (Mosquito Lagoon, Banana River, North and Central IRL), the current (1999) 61,884 acres of seagrass is 63% of the potential 98,274 acres of coverage (based on 1.7 m depth). The 1943 seagrass coverage was 63,238 acres; 64% of the potential acreage.”

“Within the SFWMD portion (South IRL), the current (1999) seagrass cover is 7,808 acres or 39% of the potential 19,799 acres. The early 1940s seagrass coverage was nearly the same – 7,668 acres or 39% of the potential acreage.”

“For the entire IRL, the potential coverage area for seagrass is 118,000 acres; but only 59% of that is currently covered in seagrass (69,692 acres in 1999). In general, “healthy” seagrass areas are adjacent to relatively undeveloped watersheds or in proximity to inlets, whereas areas of extensive losses are adjacent to highly developed watersheds and shorelines.”

## Region 5: South Florida

The South Florida region includes the coastal waters of Collier, Monroe, and Dade counties. This area contains approximately 63%, or more than 1.4 million acres, of the total seagrasses in Florida. The extensive Florida Bay seagrass meadow is among the largest contiguous seagrass beds on earth. On the Atlantic side of the Florida Keys, seagrasses are closely associated with coral patch reefs.

Though sparse, long-term coverage data for this region indicate a significant decline in seagrasses in urbanized portions such as the Miami-Dade area, where an estimated 43% percent of seagrasses in the north section of Biscayne Bay have been lost since the 1940s. Seagrasses in Dade and Monroe counties also exhibit some of the highest rates of propeller scarring in Florida. Seagrass managers have recommended the implementation of a four-point approach (education, channel marking, enforcement, and limited-motoring zones) to reduce propeller scarring in these counties and other portions of the state where significant scarring occurs. In addition, the Florida Keys National Marine Sanctuary is currently implementing its detailed 10-point program addressing channel and reef marking, education and outreach, enforcement, mooring buoys, regulation, research and monitoring, submerged cultural resources, volunteers, water quality, and zoning issues for the management of seagrasses and other resources in the area under its jurisdiction.

Beginning in 1987, Florida Bay experienced a dramatic bay-wide seagrass decline, substantially reducing coverage and biomass. The unexpected and incompletely understood die-off has been attributed to a combination of factors, including widespread and persistent microalgae blooms, sediment sulfide toxicity, hypersalinity due to multi-year drought, and infection of grasses by the slime mold *Labyrinthula*. Between 1984 and 1994, the estimated biomass of three seagrasses declined sharply: turtle grass by 28%; manatee grass by 88%, and shoal grass in Florida Bay declined by 92%. Although the rate of decline has slowed considerably in recent years, seagrass coverage losses have continued in parts of the bay, possibly jeopardizing their long-term viability. Chronic light reductions and increased water turbidity are thought to be important factors in the ongoing decline.

## 5. ORGANIZATIONS INVOLVED IN SEAGRASS MANAGEMENT

A variety of agencies in all branches of government and many non-governmental organizations are involved in seagrass management in Florida. A brief overview of these potential partners and their roles is provided in the tables that follow. More extended summaries of legal authorizations and agency roles and responsibilities are provided in Appendix A.

As the experience in Texas has shown, successful development of a coordinated statewide management program will require the active participation of the full range of agencies and stakeholder groups that have an interest in seagrass resources.

<b>FEDERAL AGENCIES</b>		
<b>Agency</b>	<b>Authority</b>	<b>Primary Responsibility</b>
All Federal Agencies	National Environmental Policy Act (NEPA)	Provides for consultation among applicable agencies, through preparation and review of environmental assessments (EA) and environmental impact statements (EIS) regarding proposed federal actions
U.S Army Corps of Engineers	Section 404 of the Federal Water Pollution Control Act (Clean Water Act)	Regulates dredging and discharges of fill material
U.S. Environmental Protection Agency	National Pollution Discharge Elimination System (NPDES) of the Clean Water Act	Regulates domestic and industrial wastewater discharges and certain municipal stormwater discharges
	Non Point Source Program (NPS) of the Clean Water Act	Oversees development of state management programs to address non-point source runoff; provides Section 319 grant funds
	Section 320 of the Clean Water Act	Administers National Estuary Programs and Gulf of Mexico Program
	Florida Keys National Marine Sanctuary (FKNMS) and Protection Act, under the National Marine Sanctuaries Act	Develops and implements water quality and resource protection programs for the FKNMS

<b>FEDERAL AGENCIES (Cont.)</b>		
<b>Organization</b>	<b>Authority</b>	<b>Primary Responsibility</b>
National Oceanic and Atmospheric Administration	Coastal Zone Management Act	Approves and oversees state Coastal Management Programs
	Section 315 of the CZMA	Administers National Estuarine Research Reserves (NERR)
	Magnuson-Stevens Fisheries Conservation and Management Act	Establishes national standards for fishery conservation and develops fishery management plans
	Sustainable Fisheries Act; Amendment to MSFCMA	Designates essential fish habitat (EFH) areas and develops appropriate conservation measures for those areas
	Endangered Species Act	NOAA's National Marine Fisheries Service implements the ESA for sea turtles and Johnson's seagrass, including management of critical habitats
	Florida Keys National Marine Sanctuary (FKNMS) and Protection Act of the National Marine Sanctuaries Act	Develops and implements comprehensive management plans and accompanying regulations for management of FKNMS
	No-Net-Loss Policy	NOAA's National Marine Fisheries Service oversees this policy for wetlands protection and mitigation in marine waters
	Submerged Aquatic Vegetation Policy of NOAA's Atlantic State Fisheries Commission	Provides for the conservation, preservation and restoration of SAV along the Atlantic Coast of the U.S.
U.S. Coast Guard		Develops regional oil spill response plans; enforces federal fisheries and marine mammal protection laws
US Department of the Interior Mineral Management Service		Conducts surveys of nearshore coastal waters
US Department of the Interior National Park Service		Manages National Park lands, including those with submerged lands and seagrasses

<b>FEDERAL AGENCIES (Cont.)</b>		
<b>Organization</b>	<b>Authority</b>	<b>Primary Responsibility</b>
U.S. Fish and Wildlife Service	Endangered Species Act (ESA)	Requires federal agencies to consult on activities that affect listed species
	Fish and Wildlife Coordination Act	Requires federal agencies to consult with USFWS on development activities in order to conserve resources, including seagrasses and other submerged aquatic vegetation
	USFWS Mitigation Policy	Establishes policies to mitigate for resource losses, including seagrasses and other submerged aquatic vegetation
	Refuge Administration Act	Establishes and manages National Wildlife Refuges
	Coastal Grants Program	Provides funding for restoration of coastal habitats, including seagrasses and other submerged aquatic vegetation

<b>NON-FEDERAL ORGANIZATIONS (STATE AND REGIONAL AGENCIES, LOCAL GOVERNMENTS, NGOs)</b>		
<b>Organization</b>	<b>Authority</b>	<b>Primary Responsibility</b>
Board of Trustees of the Internal Trust Fund for the State of Florida	Chapter 253 FS; Chapter 18 FAC (state lands)	Holds title to the natural resources located within three miles of the Atlantic coast and nine miles of the gulf coast
	Chapter 18-21, FAC sovereign submerged lands management	Manages and protects sovereign lands, especially those important to public drinking water supply, shellfish harvesting, public recreation, and fish and wildlife propagation and management
	Chapter 18-18, FAC (Florida Bay Aquatic Preserve) and Chapter 18-20, FAC (other aquatic preserves)	Develops and implements comprehensive management programs to preserve, protect, and enhance designated aquatic preserves
Florida Department of Environmental Protection	Chapter 62-302, FAC Surface Water Quality Standards	Conserves waters of the state to protect, maintain, and improve water quality for public water supplies, propagation of fish and wildlife, and other uses; includes nutrient enrichment management specifically to protect seagrasses
	Chapter 62 FAC	Serves as permitting authority for waterfront developments, marinas, wastewater treatment plants, and industrial wastewater discharges  Manages state parks and aquatic preserves  Coordinates emergency response programs for oil spills  Administers non-regulatory stewardship programs such as Clean Marina Program  Guides implementation of the state's Coastal Management Program

<b>NON-FEDERAL ORGANIZATIONS (Cont.)</b>		
<b>Organization</b>	<b>Authority</b>	<b>Primary Responsibility</b>
Florida Department of Agriculture and Consumer Services	Chapter 5 FAC	Ensures safety of shellfish harvesting areas  Protects the state's agricultural and natural resources by promoting environmentally safe agricultural practices, including aquaculture
Florida Fish and Wildlife Conservation Commission	Chapter 68 FAC	Creates and enforces fish and boating laws  Oversees the Florida Marine Research Institute, which conducts research in seagrass biology, status and trends, and impacts  Provides regulatory review of water-based development  Establishes state manatee protection sanctuaries and speed zones
Florida Department of Community Affairs	Chapter 9 FAC	Coordinates reviews of developments of regional impact (DRI)  Oversees implementation of local comprehensive land use plans as specified by Florida statutes  Oversees implementation of land use plans for state Areas of Critical Concern
Water Management Districts	Chapter 40 FAC	Regulate projects related to water quality and quantity  Implement the state's Surface Water Improvement and Management (SWIM) program

<b>NON-FEDERAL ORGANIZATIONS (Cont.)</b>		
<b>Organization</b>	<b>Authority</b>	<b>Primary Responsibility</b>
Port Authorities	Laws of Florida (separate chapter for each authority)	Regulate docks and other structures within their sovereign land ownership  Develop emergency response plans for oil or chemical spills
National Estuary Programs	Clean Water Act Section 320	Develop and coordinate implementation of watershed management plans  Coordinate data collection and distribution  Develop and distribute outreach materials
Regional Planning Councils	Chapter 29 FAC	Coordinate local review of DRIs  Assist communities in long-range planning, including natural resource protection
Local Governments	Local ordinances, delegated permitting authority	Wide range of responsibilities, including: <ul style="list-style-type: none"> <li>• Delegated permitting of wetland and shoreline impacts, point and non-point source discharges</li> <li>• Managing parks and aquatic preserves</li> <li>• Regulating (by ordinance) boating speeds and manatee and seagrass protection zones</li> </ul>
Non-Governmental Organizations		Many activities, including: <ul style="list-style-type: none"> <li>• Lobbying for coastal resource use and protection</li> <li>• Environmental education, public outreach and involvement</li> </ul>

## 6. SETTING SEAGRASS MANAGEMENT GOALS

### Importance of Quantitative Goals

In recent decades, natural resource managers have made increasing use of quantitative planning methods that are based on the adoption of numeric, science-based goals and regular assessment of progress toward those goals. The approach of adopting and measuring progress toward quantitative goals offers a number of benefits:

- Increased accountability
- Clearer identification of monitoring priorities
- Improved efficiency in the allocation of funding and manpower
- More rapid identification of management actions that are most cost-effective and environmentally beneficial

Setting quantitative, science-based seagrass management goals and regularly measuring and reporting progress in achieving them is also critically important for securing support from the citizens of Florida and their elected officials.

### Existing (Local) Goals

Indian River Lagoon and Tampa Bay currently have quantitative, consensus-based seagrass coverage goals.

In the Indian River Lagoon, the Indian River Lagoon National Estuary Program has developed coverage goals for various lagoon segments based on the 1943 total estimated seagrass coverage of 91,570 acres. The goals assume sufficient water quality and light attenuation to allow seagrasses to grow to approximately 5.6 feet in depth. Achieving coverage targets will be accomplished by the adoption of specific pollutant load reduction goals (PLRGs) for each segment. The goals, based on the difference between the 1943 estimates and present-day coverage, will be updated every 2–3 years through aerial mapping and digitization conducted by the St. Johns River Water Management District.

For Tampa Bay, the Tampa Bay Estuary Program (TBEP) has adopted a long-term goal of recovering 12,350 acres of seagrasses bay-wide, which would increase seagrass coverage to about 38,000 acres. This is the estimated coverage present in the bay in the early 1950s, excluding areas permanently altered by dredging and filling activities. Water clarity in the bay has improved dramatically since 1985, and water quality models developed by TBEP indicate that clarity is now sufficient to allow achievement of the seagrass recovery goal, over time, through natural regrowth. To maintain existing water clarity and sustain the seagrass recovery process, TBEP has adopted a nutrient management goal of capping the nitrogen loads entering the bay at the average levels observed during 1992–1994.

Between 1996 and 2010, nitrogen loadings to Tampa Bay are projected to increase by 7 percent because of population growth and related development. This equates to an estimated increase in annual nitrogen loads of slightly less than 17 tons per year; to maintain the bay's current nitrogen

levels, local governments and industries need to reduce or prevent cumulative increased loadings to the bay by this amount.

The Tampa Bay Nitrogen Management Consortium, a public-private partnership, has agreed to collectively reach this goal by conducting a variety of nitrogen load reduction projects, including land acquisition, habitat restoration, construction of upgraded stormwater treatment systems, and reductions in domestic and industrial point source discharges and air emissions. Consortium partners report their pollution-control projects to TBEP, which has developed a database to track progress by calculating reductions in nitrogen loads for various types of projects.

Monthly bay-wide water quality monitoring provides an overall measure of the success of these efforts. The monitoring, conducted by local governments, is combined with aerial photography and digitized mapping of Tampa Bay's seagrass beds. The Southwest Florida Water Management District conducts monitoring every 2–3 years.

### **Recommendations for the Development of Statewide Goals**

The state of Florida, through its existing resource management agencies, should take the lead in developing quantitative, consensus-based seagrass coverage goals for each of the five regions shown in Fig. 1. These goals should be specific, measurable, realistic, and environmentally and technically sound. Ideally, they should be achievable within a specified time (e.g., 25 years). Goals should be developed based on input from a wide range of stakeholders, including resource managers; scientists; resource user-groups; environmental organizations; trade associations; agricultural, development and industrial interests, and the public and elected officials. The sum of these regional goals will represent the statewide seagrass management goal.

To develop these goals, a statewide seagrass management technical advisory committee (TAC) should be assembled. The group could be modeled after the committee DEP recently used in the development of the state's "Impaired Waters Rule" (Chap. 62-302 FAC). TAC members, who should be familiar with regional and statewide seagrass management issues and methods, should be appointed by the heads of the Department of Environmental Protection, the Fish and Wildlife Conservation Commission, the Department of Community Affairs, the Department of Agriculture and Consumer Services, and the five water management districts. Each agency should also designate one or more senior administrative staff members to review draft recommendations developed by the TAC. The Florida Coastal Management Program should fund, organize, coordinate, and provide logistical support to the TAC.

The TAC should hold one or more public meetings in each of the state's five seagrass regions. The meetings should be well-advertised, and provide an opportunity for input from stakeholders who are not committee members. Technical staff from organizations involved in seagrass management at the regional level should be invited to participate in the regional meetings. These organizations could include the estuary programs, estuarine research reserves, other preserves, parks and wildlife refuges, local governments, colleges and universities, and relevant NGOs. Federal agencies with regulatory responsibilities that affect seagrasses within the regions should also be invited to participate in the goal-setting process.

## 7. DEVELOPING AND IMPLEMENTING A STATEWIDE STRATEGY

### Background

If the statewide seagrass management effort is to be successful, it must be practical, adaptable, and forward-looking. It should allow for flexibility, and revision of goals as conditions change and new information becomes available. It should provide clear, concise regional and statewide strategies that can be implemented across jurisdictional boundaries. It should serve as a blueprint guiding efforts at all levels of government and should also include the private sector, civic organizations, and other NGOs. It should recognize, support, and incorporate successful existing management programs, building on the accomplishments of local programs rather than duplicating their efforts. Moreover, it should promote new policies to fill identified gaps and ensure that adequate management attention is paid to seagrasses in all regions of the state. A cooperative, coordinated statewide approach of this type will provide managers in each region with consistent direction and a means of linking their efforts to the larger goal of protecting and enhancing all seagrass resources.

Once appropriate seagrass coverage goals are identified at the regional level, a logical sequence of steps can be used to develop and implement management strategies for individual regions and water bodies. A recommended approach, based on a logical framework developed by the National Research Council for estuarine water quality management, is shown in flowchart form in Figure 3.

### Identifying Potential Conservation and Restoration Areas

The threats to and health of seagrass communities vary substantially within and between the five regions shown in Fig. 1. While some areas need restoration efforts to re-establish seagrasses to ideal levels, other areas primarily need conservation to maintain current seagrass abundance and health levels. Techniques for managing these areas will necessarily differ. Management efforts in restoration areas will focus primarily on *reducing* and eventually *reversing* water quality degradation, propeller scarring, or other causes of seagrass losses, and *restoring* seagrass habitats. Management efforts in conservation areas will focus primarily on *preserving* robust seagrass resources by *preventing* potential problems that could lead to future declines in coverage or habitat quality.

**Panhandle:** Seagrasses in the Panhandle region occur primarily in shallow nearshore areas. The limited amount of seagrass present in the region is potentially at risk from inappropriately conducted shoreline development, dock construction, and boat operation. In general, seagrasses in Panhandle estuaries apparently remain at or near historic levels; although, some areas, such as Pensacola Bay, Choctawhatchee Bay, West Bay, and St. Andrew Bay, have experienced losses. The recommended regional strategy is a combination of conservation and, in areas where losses have occurred, restoration projects.

**Big Bend:** Throughout the Big Bend region, large expanses of seagrasses occur. Some of the world's largest low-density, deepwater seagrass meadows exist offshore from the state's nine-mile natural resource boundary. In the near future, the main emphasis of this region's seagrass

management will presumably focus on conservation rather than restoration. Human population growth and associated development pressures are just beginning to occur. To prevent water quality degradation, a full range of management practices, including stormwater management, centralized wastewater systems, land use BMPs, and public education and outreach will be needed.

**Gulf Peninsula:** The northern portion of this region, including St. Joseph Sound, Clearwater Harbor, Boca Ciega Bay, Tampa Bay, and Sarasota Bay, has a long history of urbanization and corresponding reductions in seagrass coverage. Recent assessments by Pinellas County indicate that substantial seagrass coverage, which approaches 60% of the coverage currently present in Tampa Bay, remains in the Clearwater Harbor and St. Joseph Sound area. The county will seek implementation of a combined restoration and conservation effort in those areas in the near future. The Tampa Bay Estuary Program and the Sarasota Bay National Estuary Program have both identified restoration as the primary management strategy for their water bodies. The Charlotte Harbor National Estuary Program has identified the southern portion of the region, which includes Lemon Bay, Gasparilla Sound, Charlotte Harbor, Pine Island Sound, Matlacha Pass, Estero Bay, and the Caloosahatchee River estuary, as a seagrass conservation area.

**South Florida:** Although it contains most of the state's nearshore seagrass coverage, much of this region appears to be a restoration area. Boat groundings and propeller scarring damage seagrasses in the shallow waters of the Florida Keys, Florida Bay, and Biscayne Bay. The cumulative effects of these individually localized physical perturbations are so severe that the Florida Keys National Marine Sanctuary (FKNMS) developed a judicially-based damage assessment and restoration process to facilitate the recovery of damaged sites. In addition to these clearly anthropogenic seagrass losses, by 1994, the incompletely-understood "die-off" that began in Florida Bay in 1987 caused dramatic reductions in the biomass of three seagrasses: *Thalassia* by an estimated 28%; *Syringodium* by 88%, and *Halodule* by 92%. Although the loss rate from "die-off" has slowed considerably in recent years, researchers have described the long-term future of seagrasses in Florida Bay as "uncertain."

**Atlantic Peninsula:** Assessments conducted by the Indian River Lagoon National Estuary Program, in cooperation with the St. Johns River Water Management District and the South Florida Water Management District, indicate that the northernmost portion of the Indian River Lagoon and adjacent areas of the Mosquito Lagoon and Banana River have experienced relatively small amounts of seagrass loss. An emphasis on conservation appears to be the most appropriate management approach for these waters. More urbanized areas have reportedly experienced significant amounts of seagrass loss due to physical removal through dredging and filling and reduced water quality. An emphasis on restoration appears needed in these areas.

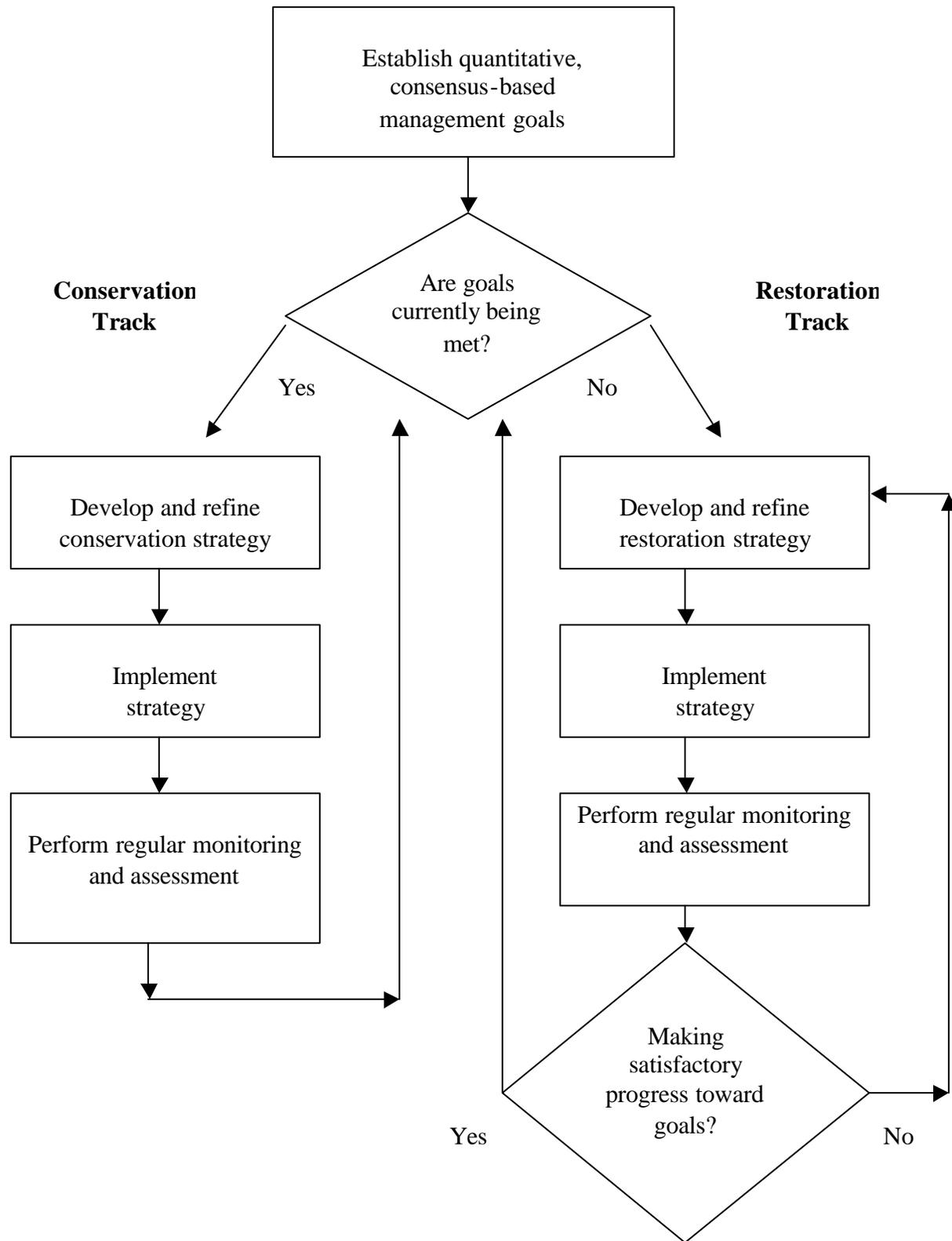


Figure 3. Recommended seagrass management process in conservation and restoration areas

## **Developing Management Strategies**

The TAC assembled to develop the regional and statewide seagrass coverage goals should also develop clear strategies for achieving those goals.

As in the goal-development process, the TAC should hold one or more public meetings in each of the state's five seagrass regions. The meetings should be well advertised, and provide an opportunity for input from stakeholders who are not committee members. Invited participants should include technical staff members from the estuary programs, parks and preserves, local governments, colleges and universities, non-governmental organizations, and other stakeholders with an interest in seagrass management at the regional level. Federal agencies with regulatory or resource management responsibilities within each region should also be brought into the process.

For each region, the TAC should develop specific conservation and restoration strategies based on the approach shown in Fig. 3. These strategies may involve both regulatory and non-regulatory elements and should include agency responsibilities and timelines for achieving the regional and statewide seagrass coverage goals described in Section 2. A summary of these regional strategies should be published, in draft form, to provide an additional opportunity for review and comment from stakeholders who are not members of the committee. A draft-form statewide strategy document, revised in response to stakeholder input, should be provided for the review and approval of the heads of the sponsoring agencies.

## **Implementing the Strategies**

Following approval of the strategy document by the agency heads, an interagency memorandum of understanding (MOU) should be drafted to guide its implementation. Participation in the MOU should be open to each sponsoring agency. To the extent possible given the complications that arise in the development of multi-party agreements, — participation should also be open to other public or private organizations that wish to make a significant commitment to statewide seagrass management. The MOU should specify the steps each participating organization proposes to take to implement the agreed-upon regional strategies, the timeline on which those steps are proposed to occur, and the resources that will need to be budgeted to accomplish the work. A multi-party, interlocal agreement developed in the Tampa Bay region in 1998 to guide the implementation of a community-based Tampa Bay management plan, could serve as a template for the statewide MOU.

## 8. EVALUATION AND REPORTING

### Importance of Tracking Progress Toward Goals

Regular evaluations of status and trends in seagrass coverage and condition are essential for proper management of the resource. Methodologically consistent long-term mapping and monitoring programs, providing information on areal coverage, species composition, health, and spatial and temporal fluctuations in the distribution of seagrass communities are particularly helpful in assessing progress toward meeting the state's management goals. This type of assessment alerts managers to new problems or issues in a timely fashion and assures Floridians of the state's commitment to protecting seagrass habitats.

The localized influences of human activities such as dock construction or vessel grounding and propeller scarring incidents need to be evaluated. It is important to estimate the ecological and economic costs associated with those influences and to assess the success of habitat restoration projects that are carried out as mitigation.

### Mapping

Several local and regional mapping programs have been conducted or are currently underway in Florida. These efforts are sponsored by a variety of agencies and organizations.

Traditionally, assessments of coverage and condition used a combination of aerial photography and on-site monitoring. While these continue to be the primary methods available to managers, research is currently underway on a variety of remote sensing techniques that may become available for use by seagrass management programs in the near future.

Recent and historical mapping data are available from several internet-based sources:

- NOAA Coastal Services Center, Benthic Habitat Mapping program (<http://www.csc.noaa.gov/crs/bhm>)

This Web site provides benthic habitat maps of Apalachicola Bay, Estero Bay, Florida Bay, Florida Keys, Indian River Lagoon, and deep seagrass beds on Florida's west continental shelf. Data are georeferenced and validated. The files are provided to the user in ARC/INFO<sup>®</sup> Export or ArcView<sup>®</sup> Shapefile format. All files are zipped, using PKZIP<sup>®</sup>, for quicker downloading. Each zip file contains the polygon files and the Federal Geodetic Data Committee (FGDC) compliant metadata file. Projection and datum information, as well as classification system, are included in the metadata records.

- USGS National Wetlands Research Center  
(<http://sdms.nwrc.gov/pub.metrec.html>)

This Web site contains downloadable GIS maps of Apalachee Bay SAV (1992), Choctawhatchee Bay SAV (1992), Florida Panhandle coastal habitats (1996), Pensacola Bay SAV (1960s, 1992), Saint Andrew Bay, and Tampa Bay habitats (1956, 1972, 1982).

- Florida Marine Research Institute (FMRI)  
(<http://floridamarine.org/seagrass>)

This Web site contains GIS maps, data, technical reports, and public education and outreach products.

- Southwest Florida Water Management District (SWFWMD)  
(<http://www.swfwmd.state.fl.us/data/dataonline.htm>)

This Web site provides downloadable GIS maps showing assorted 1988–1999 seagrass coverages in Clearwater Harbor, Tampa Bay, Sarasota Bay, Lemon Bay, and Charlotte Harbor .

- Florida Institute of Technology  
(<http://probe.ocn.fit.edu/SAVproject/SAV.html>)

The Web site provides the description of the development of a protocol to use hyperspectral imagery to map seagrass.

- Florida International University  
(<http://serc.fiu.edu/seagrass/!CDreport/DataHome.htm>)

This Web site provides seagrass mapping and monitoring data from the Florida Keys.

- University of Miami  
([http://library.miami.edu/netguides/environ\\_fl.html](http://library.miami.edu/netguides/environ_fl.html))

This Web site offers links to sites that provide maps, data, and background information on Florida habitats and resource management issues.

- ESRI Conservation Program Resources  
(<http://www.conservationgis.org/links/marine2.html>)

This Web site offers links to sites that provide maps, data, and background information on national resource management issues.

Additionally, private entities have also funded seagrass mapping efforts from time to time. These entities are primarily utilities and other companies operating industrial facilities with permitted discharges to nearshore waters. Depending on company policies and the purpose and scope of

the mapping effort, the resulting images and maps may be available to researchers and resource managers on a case-by-case basis.

## Monitoring

In Florida, monitoring of seagrass condition has been done in relatively localized areas, such as individual bays, estuaries, parks, or other management units, rather than on a regional or statewide scale. Local governments, water management districts, or state or federal resource management and agencies typically carry out the projects. Information on monitoring program design is available from a number of sources (see Section 10).

Most recent seagrass monitoring programs have included one or more of the following components:

- Species composition
- Short-shoot density and morphology
- Standing crop
- Epiphyte loads
- Water quality
- Water clarity
- Light attenuation/PAR
- Water depth (with emphasis on the deep edges of seagrass beds)
- Primary productivity

In addition to these frequently monitored parameters, topics of emerging interest have included the presence and absence of plant pathogens and the potential effects of sediment chemistry on the distribution and abundance of individual seagrass species.

An overview of monitoring programs is provided in the in the Florida Seagrass Manager's Toolkit developed in 2003 for the FWC-Florida Marine Research Institute. The institute also maintains a seagrass research and conservation projects database on its Web site at <http://www.floridamarine.org>.

## Reporting

Presently, only a handful of local initiatives exist to provide regular and timely reports on seagrass coverage or condition in Florida; no statewide programs provide this information. Perhaps the most extensive local program is that implemented by the Southwest Florida Water Management District to support its SWIM program and the National Estuary Programs in Tampa Bay, Sarasota Bay, and Charlotte Harbor. In addition to those estuaries, the SWFWMD program also includes the waters of Clearwater Harbor and St. Joseph Sound. Aerial photography of seagrass beds in these areas is performed every 2–3 years, and the results are ground-truthed and digitized on GIS maps. Results are disseminated through regular reports to the TACs associated with the SWIM and National Estuary programs, and through occasional SWFWMD publications. The Indian River Lagoon National Estuary Program, the South Florida Water Management District, and St. Johns River Water Management District are conducting a similar program for the Indian River Lagoon .



## **Recommended State Role**

With support from the Department of Environmental Protection, the five regional water management districts, and other appropriate agencies, the Florida Fish and Wildlife Conservation Commission should take the lead in developing a methodologically consistent statewide program for mapping and monitoring seagrass coverage and condition.

The results of this mapping and monitoring program should be summarized and reported to the public in a timely manner (e.g., every 2–3 years) and should be made available to managers, scientists, and interested citizens through a relational database that is publicly accessible via the Internet. The state should use the 2–3 year summary reports to evaluate progress toward meeting its regional and statewide seagrass management goals. On a less frequent basis (e.g., every 4–6 years), the results should be used to assess, and if necessary refine and improve, the state's regional conservation and restoration strategies, following the NRC-recommended process shown in Fig. 3.

## 9. MANAGEMENT-RELATED RESEARCH

### Background

Successful resource management is based on solid technical understanding of the target resource and the natural and man-made stressors that affect it. There is a general consensus that Florida's previous and current seagrass research efforts are not uniform in all regions and do not systematically address some key issues and concerns.

Managers and scientists participating in various seagrass symposia or workshops in the past decade have identified key research needs:

- Identification of critical water quality conditions for successful seagrass conservation and restoration
- Evaluation of factors, other than water quality, which may influence seagrass recruitment and survival (factors include epiphyte coverage, macroalgal density and distribution, disease, sediment quality, current velocity, and wave energy)
- Effects of propeller scarring on seagrass coverage and the habitat value provided by scarred beds
- Improved forecasting of seagrass population trends
- "Micro" (patch-size) dynamics, related to factors such as sediment deposition rates and nutrient availability
- More detailed evaluation of the economic value of seagrass habitats
- Additional assessment of seagrass transplanting methods, to determine methods' effectiveness in relation to one another and to natural recruitment
- Development of an online database documenting the outcomes of seagrass restoration and transplant projects
- Scientific assessment of factors affecting the success of seagrass restoration projects
- Assessment of the resilience of restored sites in the presence of natural disturbances
- Additional research on the biology and ecology of native seagrass species (e.g., effects of sexual vs. asexual reproduction on regional populations)

### Recommended State Role

The FWC-Florida Marine Research Institute should take the lead in identifying and prioritizing the state's management-related seagrass conservation and restoration research needs. The institute should estimate the costs of carrying out the necessary research and—working in cooperation with researchers in the state university system, management agencies, and private organizations—seek funding to carry out the work. Potential funding sources include the state budget, federal grant programs, private foundations, public-private partnerships, and cooperative funding efforts carried out with local governments, water management districts, and public and private colleges and universities.

## **10. PUBLIC OUTREACH**

### **Background**

Since education can lead to behavioral changes that significantly reduce human impacts to seagrasses, fostering public awareness of the importance of seagrass habitats is an integral part of a successful statewide management plan. Many current local initiatives target boaters and other waterway users as well as waterfront residents whose landscaping practices or septic disposal systems may pose a threat to water quality and seagrass health.

The Florida Seagrass Alliance is a consortium of environmental educators representing key government and non-government organizations concerned with seagrass management. The alliance recently initiated a statewide public awareness program that led to the Governor's proclamation designating March as Florida's annual Seagrass Awareness Month. To facilitate promotion of Seagrass Awareness Month, alliance members developed and distributed a "Seagrass Toolbox" that contains fact sheets, press releases, and radio, print, and television public service advertisements. Similar programs could be initiated on a statewide basis.

### **Recommended State Role**

The state of Florida should take the following steps to improve public awareness of the value of seagrasses:

- Support existing outreach efforts by assisting in the distribution of accurate information about the status of Florida's seagrasses and stressors affecting them.
- Prepare and distribute a "Citizens' Report on the Status of Florida's Seagrasses" every two to three years.
- Develop a statewide teaching curriculum introducing Florida students to seagrasses, their environmental and economic value, and the state's seagrass conservation goals.

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**Appendix A**

**Federal and Non-Federal Agency  
Legal Authority, Roles, and Responsibilities**

## FEDERAL AGENCIES

### Legal Authority

Federal authority addressing protection of submerged aquatic vegetation, including seagrasses, is found in the following legislation and executive orders:

#### National Environmental Policy Act (NEPA)(42 U.S.C § 321)

This act requires the preparation of an environmental impact statement (EIS) for every major federal action that will significantly affect the environment. The EIS must address the following:

- The environmental effects of the action
- Alternatives to the proposed action
- The relationship between local short-term uses of humans' environment and the maintenance and enhancement of long-term productivity
- Any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented

NEPA provides a framework for seeking consultation from applicable federal or state agencies with an interest in the environment potentially affected by the project.

#### Federal Water Pollution Control Act (“Clean Water Act”)(33 U.S.C. § 1251)

The Clean Water Act (CWA) establishes the basic parameters for restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The primary mechanism regulating discharge of pollutants into waterways is the National Pollutant Discharge Elimination System (NPDES), administered by the U.S. Environmental Protection Agency. Under the NPDES program, a permit is required from EPA or an authorized state for the discharge of any pollutant from a point source into the waters of the U.S.

In 1987, the CWA was amended to include the current non-point sources (NPS) program addressing stormwater runoff. Under this program, states must develop management programs to address non-point runoff, including the identification of best management practices and measures. In addition, section 319 authorizes grants to assist states implementing approved management programs.

The section 404 permit program of the CWA is implemented by the U.S. Army Corps of Engineers. Section 404 requires a permit for the discharge of dredged or fill materials into waters of the U.S. that lie inside of the baseline for the territorial sea and of fill materials into the territorial sea within three miles of shore. Although the COE has the permitting responsibility under the section 404 program, in Florida and almost all other states, EPA has the right to review and comment on the effects of proposed dredge and fill activities. EPA also has the right to prohibit discharges that would have an unacceptable effect on municipal water supplies, shellfish beds, fishery areas, wildlife, and recreational areas.

Submerged Lands Act (43 U.S.C. § 1301)

The Submerged Lands Act grants states title to the natural resources located within three miles of their coastlines (nine miles for Texas and the gulf coast of Florida). For purposes of the SLA, the term “natural resources” includes oil, gas, and all other minerals.

More than one state entity may implement state management authority for oil and gas exploration and production on submerged state lands.

Coastal Zone Management Act (CZMA) (16 U.S.C. § 1451)

CZMA strives to protect and preserve coastal resources. Through the CZMA, states are encouraged to develop their own coastal zone management programs (CZMPs) to allow economic growth that is compatible with the protection of natural resources, the reduction of coastal hazards, the improvement of water quality, and sensible coastal development. CZMA provides financial and technical assistance for coastal states to manage their coastal zones in a manner consistent with CZMA standards and goals.

For federal approval, a state CZMP must meet certain criteria:

- Identify the coastal zone boundaries
- Define the permissible land and water uses within the coastal zone that have a direct and significant impact on the coastal zone and identify the state’s legal authority to manage these uses
- Inventory and designate areas of particular concern
- Provide a planning process for energy facilities siting
- Establish a planning process to assess the effects of shoreline erosion and to decrease those effects
- Facilitate effective coordination and consultation between regional, state, and local agencies.

The National Oceanic and Atmospheric Administration (NOAA) provides the requisite federal approvals for CZMPs and oversees the programs.

States with approved CZMPs are eligible for financial assistance and are able to review federal permits and activities that affect their own coastal zone. The Secretary of Commerce may override a state’s objection to a project or activity if the Secretary finds that that the federal license or permit is consistent with the objectives of the CZMA or is necessary in the interest of national security.

Among several amendments to the CZMA is Section 315, which establishes the National Estuarine Research Reserve System. States may seek NERR designation for areas suitable for long-term research and conservation that qualify as biogeographic and typological representations of estuarine ecosystems. .

Magnuson-Stevens Fisheries Conservation and Management Act (16 U.S.C. § 1801)

This Act assigns to the U.S. sovereign and exclusive fishery management rights over all fish and all continental shelf fishery resources within the Exclusive Economic Zone.

The MSFCMA establishes national standards for fishery conservation and management within the EEZ. These standards are created through the efforts of eight regional fisheries management councils composed of state officials with fishery management responsibility, the regional administrators of the National Marine Fisheries Service, and individuals appointed by the Secretary of Commerce. The councils are responsible for developing fisheries management plans for each fishery under their authority that warrants conservation and management. The plans describe the fisheries and establish conservation and management measures applicable to both U.S. and foreign fishing vessels.

Sustainable Fisheries Act: Amendments to MSFCMA (P.L. 104-297)

Enacted in 1996, the SFA establishes guidelines for development of fisheries management plans that expand on previously adopted national standards. One of the key guidelines calls for designation of Essential Fish Habitat (EFH), identifying and describing these areas, and evaluating adverse effects and appropriate conservation and enhancement measures.

Endangered Species Act

The Endangered Species Act of 1973 establishes a process for identifying, protecting, and restoring declining plant and animal populations.. The Act authorizes the use of all methods and procedures necessary to bring any endangered or threatened species to the point at which those measures are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management. To protect habitats essential to the conservation of a listed species and which may require special management considerations or protection, the act also authorizes the designation of "critical habitat" for a threatened or endangered species..

The primary federal agencies responsible for implementation of the ESA are the U.S. Fish and Wildlife Service (i.e. Florida manatee) and NOAA's National Marine Fisheries Service (i.e. sea turtles, Johnson's seagrass).

Protection of Wetlands (Executive Order 11990, 1974)

This executive order establishes federal policy to "minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands" when carrying out federal activities.

No-Net-Loss Policy (White House Office on Environmental Policy, 1993)

This presidential policy, which applies to all federal agencies, states that wetlands should be conserved however possible and that acres of wetlands transformed for other uses must be mitigated through restoration and creation of wetlands elsewhere.

Submerged Aquatic Vegetation Policy (Atlantic States Marine Fisheries Commission)

This policy provides for the conservation, preservation, and restoration of seagrasses and other submerged aquatic vegetation along the Atlantic coast of the U.S.

## **FEDERAL AGENCY ROLES AND RESPONSIBILITIES**

### U.S. Army Corps of Engineers

Responsible for maintaining navigational channels; responsible for permitting of projects specified in Section 404 requirements; responsible for coordinating Environmental Impact Statement reviews and interagency consultations for above projects

### U.S. Coast Guard

Develops regional oil spill response plans and is the primary responder when oil spills occur; enforces federal fisheries and marine mammal protection laws

### U.S. Department of Commerce/National Oceanic and Atmospheric Administration/National Marine Fisheries Service

Responsible for permit reviews of applicable projects under consultation agreement with the COE and other federal agencies; responsible for identifying and designating essential fish habitat (EFH); responsible for protection of federally listed species, including Johnson's seagrass; responsible for management of National Marine Sanctuaries and associated education and enforcement efforts; oversees management of National Estuarine Research Reserves; conducts damage assessments related to groundings or oil spills

### U.S. Department of Interior/Minerals Management Service

Conducts surveys of nearshore coastal waters to identify and map deposits of commercially valuable minerals; oversees mineral extraction leases to private entities

### U.S. Department of Interior/U.S. Geological Survey

Conducts extensive research, mapping and monitoring programs of coastal habitats, including seagrass beds

### U.S. Department of Interior/National Park Service

Responsible for management of National Parks, including those with submerged lands supporting seagrass beds (Biscayne Bay), and associated education and enforcement efforts

### U.S. Environmental Protection Agency

Responsible for permitting of large-scale projects under the purview of the Clean Water Act, including industrial and wastewater facilities, and including NPDES permits; oversees regional non-regulatory waterway management programs such as the National Estuary Programs and the Gulf of Mexico Program; provides grant funding for upgrades to municipal treatment facilities and for innovative technology solution to pollution problems

### U.S. Fish and Wildlife Service

The USFWS conducts permit review of applicable water-related developments (dredge/fill activities) and federally funded and licensed projects (water diversions and impoundments) under the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*). The FWCA requires federal agencies to consult with the USFWS for the purpose of conserving fish and wildlife resources and their habitats during the planning of these projects.

The USFWS conducts consultations under section 7 of the Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*) to ensure that the existence of federally listed species is not jeopardized, and that adverse effects to such species and their habitat are minimized and/or avoided to the extent practicable. The ESA implementing regulations also authorize the USFWS to establish Florida manatee refuges and sanctuaries.

The USFWS also manages National Wildlife Refuges under the authority of the Refuge Administration Act (16 U.S.C. 668dd-668jj), including those submerged lands supporting seagrasses and other submerged aquatic vegetation.

## STATE, REGIONAL AND LOCAL AGENCIES

### Legal Authority

The Florida legislature has summarized the state's authority to manage seagrasses and their habitats and regulate human activities affecting those habitats in Chap. 253 (sovereign submerged lands), Chap. 258 (maintenance of aquatic preserves), Chap. 373 (activities in surface waters and wetlands), and Chap. 403 (pollution harming animal, plant, or aquatic life) of Florida Statutes (FS).

The Florida Administrative Code (FAC) summarizes agency rules implementing these and other laws relevant to seagrass management in Chap. 18-18 (the Florida Bay Aquatic Preserve), Chap. 18-20 (other aquatic preserves), Chap. 18-21 (sovereign submerged lands management), Chap. 62-302 (surface water quality standards), and Chap. 68C-22 (manatee sanctuary act).

“Sovereign submerged lands” are lands that lie beneath tidal or non-tidal waters held by the government by virtue of its sovereignty rather than through a grant, sale, or other conveyance. The state of Florida was admitted to the union in 1845. As a state, Florida was given title to all sovereign lands previously held by the federal government within the Florida Territory. Subsequent legal treatment of the sovereign lands issue in Florida has been quite complex, producing an inconsistent body of case law that is still under development. For the purposes of this document, however, sovereign submerged lands can be thought of as lands lying beneath tidal waters up to the mean high water line.

Existing statutes and rules addressing management of sovereign submerged lands call on the state and its agencies to, “manage and provide maximum protection for all sovereignty lands, especially those important to public drinking water supply, shellfish harvesting, public recreation, and fish and wildlife propagation and management.” Moreover, the state and its agencies are to, “manage, protect, and enhance sovereignty lands so that the public may continue to enjoy traditional uses including, but not limited to, navigation, fishing and swimming” (Chap. 18-21.001 FAC).

The state may sell submerged tidal lands to which it holds title, but prior to doing so it must determine the extent to which the action would create the following issues:

“interfere with the conservation of fish, marine and other wildlife, or other natural resources... and would result in destruction of oyster beds, clam beds, or marine productivity, including, but not limited to, destruction of marine habitats, grass flats suitable as nursery or feeding grounds for marine life, and established marine soils suitable for producing plant growth of a type useful as nursery or feeding grounds for marine life, and if so, in what respect and to what extent, and it shall consider any other factors affecting the public interests” (Chap. 253.12, FS).

Aquatic preserves are a subset of state-owned submerged lands, of “exceptional biological, aesthetic, and scientific value,” which the Florida legislature has “set aside forever as... sanctuaries for the benefit of future generations”(Ch. 258 FS). State rules addressing the

management of aquatic preserves, which are summarized in Chap. 18-20 FAC, discuss several aspects of seagrass conservation. The intent of the aquatic preserve management rules (Chap. 18-20.001 FAC) is summarized in Box 1.

A number of human activities are regulated within aquatic preserves, including shoreline hardening, aquaculture, maintenance of navigational channels, construction of pipelines and other linear infrastructure, and placement of public and private docking facilities. The highest levels of protection are provided in areas designated as “Resource Protection Area 1” (RPA 1), which are defined as areas that contain “resources of the highest quality and condition.” These resources include corals, marine grass beds, mangrove swamps, saltwater marsh, oyster bars, archaeological and historical sites, endangered or threatened species habitat, and colonial water bird nesting sites (Ch. 18-20.003 FAC).

Chapter 62-302 FAC outlines an additional policy-level mandate for seagrass management in all state waters. “Public policy of the State is to conserve the waters of the State to protect, maintain, and improve the quality thereof for public water supplies, for the propagation of wildlife, fish and other aquatic life, and for domestic, agricultural, industrial, recreational, and other beneficial uses.” Because seagrass beds are sensitive to light attenuation due to nutrient enrichment, state policy regarding excessive nutrient enrichment is particularly relevant to seagrass management efforts:

“excessive nutrients... constitute one of the most severe water quality problems facing the State. It shall be the [State’s] policy to limit the introduction of man-induced nutrients into waters of the State. Particular consideration shall be given to the protection from further nutrient enrichment of waters which are presently high in nutrient concentrations or sensitive to further nutrient concentrations and sensitive to further nutrient loadings. Also, particular consideration shall be given to the protection from nutrient enrichment of those waters presently containing very low nutrient concentrations.” (Chapter 62-302)

Under Chap. 62-302.400 FAC, all surface waters of the state have been classified according to their designated uses:

- Class I—Potable Water Supplies
- Class II—Shellfish Propagation or Harvesting
- Class III—Recreation, Propagation, and Maintenance of a Healthy, Well Balanced Population of Fish and Wildlife
- Class IV—Agricultural Water Supplies
- Class V—Navigation, Utility, and Industrial Use

Water quality classifications are arranged in order of the degree of protection required. Class I water generally has the most stringent water quality criteria and Class V the least. However, Class I, II, and III surface waters share a set of water quality criteria that have been established to protect “recreation and the propagation and maintenance of a healthy, well-balanced population of fish and wildlife.” Seagrass habitats are usually found in Class II (shellfish harvesting) or Class III (recreation and wildlife) waters.

“Impaired waters” are defined in subsection 303(d) of the federal Clean Water Act, and Sect. 403.067 FS, as waters that do not meet their designated uses or applicable water quality standards due to discharges of pollutants from point or non-point sources. Under Sect. 62-303.350 FS, a “decrease in the distribution (either in density or areal coverage) of seagrasses or other submerged aquatic vegetation” provides potential evidence of impairment due to excessive nutrient enrichment. Other potential evidence of excessive nutrient levels include “algal blooms, excessive macrophyte growth..., changes in algal species richness, and excessive diel oxygen swings” (Sect. 62-303.350 FS). Waters that are designated as “impaired” by the state of Florida and the U.S. Environmental Protection Agency are subject to the development of Total Maximum Daily Loads (TMDLs), pursuant to paragraph 303(d)(1) of the federal Clean Water Act.

**Box 1. Summary of legislative intent in the establishment of Florida's aquatic preserves**

**CHAPTER 18-20 FAC (FLORIDA AQUATIC PRESERVES)**

**18-20.001 Intent.**

(1) All sovereignty lands within a preserve shall be managed primarily for the maintenance of essentially natural conditions, the propagation of fish and wildlife, and public recreation, including hunting and fishing where deemed appropriate by the [Board of Trustees of the Internal Improvement Trust Fund], and the managing agency.

(2) Aquatic preserves which are described in Part II of Chapter 258, Florida Statutes, were established for the purpose of being preserved in an essentially natural or existing condition so that their aesthetic, biological and scientific values may endure for the enjoyment of future generations.

(3) The preserves shall be administered and managed in accordance with the following goals:

(a) To preserve, protect, and enhance these exceptional areas of sovereignty submerged lands by reasonable regulation of human activity within the preserves through the development and implementation of a comprehensive management program;

(b) To protect and enhance the waters of the preserves so that the public may continue to enjoy the traditional recreational uses of those waters such as swimming, boating, and fishing;

(c) To coordinate with federal, state, and local agencies to aid in carrying out the intent of the Legislature in creating the preserves;

(d) To use applicable federal, state, and local management programs, which are compatible with the intent and provisions of the act and these rules, and to assist in managing the preserves;

(e) To encourage the protection, enhancement or restoration of the biological, aesthetic, or scientific values of the preserves, including but not limited to the modification of existing manmade conditions toward their natural condition, and discourage activities which would degrade the aesthetic, biological, or scientific values, or the quality, or utility of a preserve, when reviewing applications, or when developing and implementing management plans for the preserves;

(f) To preserve, promote, and utilize indigenous life forms and habitats, including but not limited to: sponges, soft coral, hard corals, submerged grasses, mangroves, salt water marshes, fresh water marshes, mud flats, estuarine, aquatic, and marine reptiles, game and non-game fish species, estuarine, aquatic and marine invertebrates, estuarine, aquatic and marine mammals, birds, shellfish and mollusks;

(g) To acquire additional title interests in lands wherever such acquisitions would serve to protect or enhance the biological, aesthetic, or scientific values of the preserves;

(h) To maintain those beneficial hydrologic and biologic functions, the benefits of which accrue to the public at large.

(4) Nothing in these rules shall serve to eliminate or alter the requirements or authority of other governmental agencies, including counties and municipalities, to protect or enhance the preserves provided that such requirements or authority are not inconsistent with the act and this chapter.

*Specific Authority 120.53, 258.43(1) FS. Law Implemented 258.35, 258.36, 258.37, 258.39, 258.393 FS., Chapter 80-280, Laws of Florida. History—New 2-23-81, Amended 8-7-85, Formerly 16Q-20.01, 16Q-20.001, Amended 9-29-97.*

## **AGENCY ROLES AND RESPONSIBILITIES**

### **STATE AGENCIES**

#### Florida Department of Agriculture and Consumer Services

Responsible for safeguarding the public and supporting Florida's agricultural economy by: ensuring the safety and wholesomeness of foods (including shellfish and shellfish harvesting areas) through inspection and testing programs; assisting Florida's agriculture and aquaculture industries by supporting the production and promotion of agricultural products; and conserving and protecting the state's agricultural and natural resources by promoting environmentally safe agricultural practices and managing public lands.

#### Florida Department of Environmental Protection

Serves as the state's primary environmental regulatory agency, with permitting authority over a wide range of activities, including large waterfront residential developments, marinas, municipal and private wastewater treatment plants, and industrial wastewater discharges. Manages the state's network of parks and aquatic preserves. Provides administrative oversight of regulatory programs that have been delegated to regional water management districts and local governments. Implements non-regulatory stewardship initiatives such as the Clean Marina Program. Coordinates emergency response programs for oil spills. Oversees operation and management of state parks. Guides implementation of the state's Coastal Management Program.

#### Florida Fish and Wildlife Conservation Commission

Responsible for creation and enforcement of fishing and boating laws. Oversees the state's marine research laboratory (Florida Marine Research Institute), which conducts research in seagrass biology, status and trends, and impacts. Provides regulatory review of marinas, piers and other water-based development activities in consultation with appropriate state and federal agencies. Establishes state manatee protection sanctuaries and speed zones;

#### Florida Department of Community Affairs

Coordinates reviews of developments of regional impact (DRI); oversees implementation of local comprehensive land use plans as specified by Florida Statutes; oversees implementation of land use plans for state "areas of critical concern."

### **Regional Agencies**

#### Water Management Districts

The state's five water management districts have responsibility for permitting of projects related to both water quality and quantity (i.e. regulation of water withdrawals for both the public and private sector; regulation of stormwater management systems). They also oversee the state's Surface Water Improvement and Management (SWIM) program to restore and protect key water bodies, including the state's largest estuaries, and develop and implement environmental education programs.

Port Authorities

Responsible for permitting of docks and other structures within their sovereign submerged land ownership; responsible for developing emergency response plans for oil or chemical spills

National Estuary Programs

Implement community-based, non-regulatory management plans for specific estuaries designated by Congress, including Indian River Lagoon, Tampa Bay, Sarasota Bay and Charlotte Harbor; conduct research into problems affecting those estuaries and innovative management solutions; coordinate data collection and distribution; develop and implement educational outreach programs highlighting the importance of estuaries

Regional Planning Councils

Coordinate local reviews of Developments of Regional Impacts; assist communities in long-range planning, including natural resource protection

**Local Governments**

Local governments' planning, environmental management, and park departments have wide-ranging responsibilities over a variety of small- and large-scale development activities in and adjacent to wetlands and seagrass beds. Local agencies are also responsible for managing and maintaining local parks and aquatic preserves and regulating (by ordinance) boating speeds for both public safety and environmental protection. Additionally, local entities often maintain their own marine law enforcement units.

**Non-Governmental Organizations (NGOs)**

In Florida, a variety of nonprofit organizations and other NGOs carry out activities that affect seagrass conservation efforts, either directly or indirectly. Environmental organizations, such as the Ocean Conservancy, National Wildlife Federation, and Save the Manatee Club, lobby at the state and national levels in support of laws and government programs supporting the organizations' objectives. Similar lobbying efforts are conducted by trade organizations supporting specific occupational (e.g., commercial fishing), industrial (e.g., marine construction, shipping), and recreational and commercial (e.g., saltwater fishing and boating) interests. A number of NGOs are also involved in environmental education (e.g., the Florida Aquarium) and public involvement and outreach efforts (e.g., Tampa BayWatch) that address certain aspects of seagrass management.